PINTO WYE ARRASTRA
Joshua Tree National Monument
Twentynine Palms Vicinity
San Bernardino County
California

HAER No. CA-112

PHOTOGRAPHS

REDUCED COPIES OF MEASURED DRAWINGS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
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Washington, D.C. 20013-7127

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HISTORIC AMERICAN ENGINEERING RECORD

PINTO WYE ARRASTRA

HAER CA-112

Note:	For shelving purposes at the Library of Congress, Twentynine Palms Vicinity, San Bernardino County was selected as the "official" location for the Pinto Wye Arrastra, which is actually located in Riverside County, Indio Vicinity.
Location:	7⅝ miles south of Twentynine Palms, San Bernardino County, California UTM: 11/E589380/N3765675 Quad: Queen Mountain, 7.5 Minute Series Twentynine Palms, 15 Minute Series
Date of Construction:	circa 1920s-1930s
Present Owner:	Joshua Tree National Monument National Park Service
Present Use:	Presently in disuse.
Significance:	The arrastra is an important example of nineteenth- and twentieth-century milling technology. This specimen is unusual because it used a wooden wheel as the pivot mechanism; only two of this type are owned by the National Park Service. It is considered regionally significant because it is the only wagon wheel arrastra yet found possessing integrity of location and construction.
Project Information:	The Pinto Wye Arrastra Recording Project was cosponsored during the summer of 1991 by the Historic American Buildings Survey/Historic American Engineering Record, Joshua Tree National Monument, and Park Historic Preservation, Western Regional Office, NPS. Elizabeth Wegman-Franch, HAER Historian

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LOCATION AND HISTORIC CONTEXT

An arrastra is a simple mill which used drag stones to crush ore. The Pinto Wye Arrastra in Joshua Tree National Monument is unusual for two reasons: the mill is virtually intact and specimens in such good condition are uncommon; additionally, the central mechanism consists of two concentric wheels instead of the more typical pivoting crossbeams. This is the only intact wagon wheel arrastra on National Park Service property. Although the National Monument was created in 1936, officials were unaware of the arrastra until the wife of a park employee came across it in the mid-1960s.[1] Local residents had, however, known of its presence before that.

The Pinto Wye Arrastra is about 140 miles east of Los Angeles. There are two access roads to the site. One from the northwest via the town of Joshua Tree, and the other from the main monument road between Twentynine Palms and the southern entrance. The site is three-quarters of a mile northwest of a "Y" in the road; hence the name Pinto Wye Arrastra. The arrastra is reached by walking about twenty minutes from the road.

The southern edge of the Mojave Desert provides the setting for the site. The temperatures on summer days are frequently over 100°F; summer nights and winters are cooler. Joshua trees, Mojave yuccas, cacti, creosote bushes, and other small desert shrubs are scattered across the locale. Although it is in Riverside County, California, it is only about 600 yards south of the boundary with San Bernardino County. The arrastra is in the Twentynine Palms Mining District.

The major mining area in southern California was in the Mojave and Colorado Desert region. Today some of this area is in Joshua Tree National Monument. Euro-Americans entered the monument region in the 1870s and 1880s to mine gold and graze cattle. There was a flurry of mining activity in the Twentynine Palms District from about 1873 to 1883. The district was most

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[1] Gordon Chappell, regional historian, Western Region [National Park Service], [San Francisco], to regional director, 5 August 1976, administrative files, Joshua Tree National Monument, Twentynine Palms, 5.

productive in the 1890s and early 1900s, but in the 1930s the district had another surge of activity.[2]

In the 1920s and 1930s, when the rest of the country was undergoing the excitement and tribulations of progress in the modern era, the monument area seemed "stuck in time." Life in the desert resembled an earlier age, due to isolation and few conveniences. Residents were scattered, and transportation and communication were difficult. The roads were rough dirt tracks, there was no telephone service nor electricity (therefore no refrigeration), and it took at least 10 days to receive mail. The few residents included Native Americans, cattlemen, miners and prospectors. The desert environment was all-encompassing and unforgiving; one had to deal with it to survive.

Gold production in the West slumped after World War I and stayed low for the next decade. Low gold prices and high operating costs discouraged mining activity. The beginning of the Depression in 1929, however, also marked the beginning of a new phase in the history of California gold mining. Up to 15,000 desperate, unemployed people flocked to the state's gold bearing areas in the early years of the Depression, hoping to make a living panning, rocking, sluicing or mining the valuable metal. The earnings of these miners were meager, and their return averaged less than 50 cents a day per person. Even so, gold production increased through the decade.[3]

This twentieth-century gold rush swept across the future monument area. The Twentynine Palms newspaper estimated in the fall of 1932 that there were over 100 men working in over 100 mines in the area, and 100 more men prospecting. Willis Keys, the son of

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[2] U.S., Department of the Interior, National Park Service, Alaska/Pacific Northwest/Western Team, Historic Resource Study: A History of Land Use in Joshua Tree National Monument, by Linda Greene (Denver: Denver Service Center, 1983), 91. Hereafter cited as Greene.

[3] C. McK. Laizure, "Elementary Placer Mining in California and Notes on the Milling of Gold Ores," California Journal of Mines and Geology 30, no. 2-3 (April, July 1934): 122-23 (cited hereafter as Laizure); Lou Jacobs, "Mining Notes," Twentynine Palms Outpost, 14 September 1933, 3; and California, Department of Natural Resources, Division of Mines, Mineral Commodities of California, Bulletin 176, "Gold," by William B. Clark, (Sacramento, 1957), 223.

local resident Bill Keys, observed later "the area was sort of booming when it was supposed to be hard times."[4]

Large operators and investors gravitated towards the eastern section of the future monument (Gold Park and Dale Districts), where gold occurred in extensive deposits. Individual prospectors were attracted to the upper valleys of the western third of the monument (Twentynine Palms and Pinon Mining Districts), which contained pockets of gold. These individuals worked their claims by hand, taking perhaps a month or more to remove ten to twenty-five tons of ore. But the ore was usually worth at least $20 per ton, which gave them enough to eat.[5] These mines were too small to have their own mills, so the men often hauled their small quantities of ore to custom mills to have the gold extracted.

Then on August 10, 1936, Presidential Proclamation No. 2193 set aside 1,290 square miles in Riverside and San Bernardino Counties as Joshua Tree National Monument. The proclamation recognized valid existing mineral claims, and did not prevent continued operations of working properties. However, the new status did prevent the location of any new mining claims. Active prospecting had to stop.[6]

TECHNOLOGICAL CONTEXT

Gold ore is rock which contains gold. Much of the gold ore that occurs in California is of a type that is called free-milling. The gold occurs as small particles which can be released by crushing the rock.[7] Milling is a process which extracts valuable

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[4] Greene, 397; Lou Jacobs, "Mining Notes," Twentynine Palms Outpost, 27 October 1932, 5; and Willis Keys, interview by Reino Clark and Don Black, 7 March 1975, transcript, Joshua Tree National Monument Library, Twentynine Palms, California.

[5] Willis Keys, 7 March 1975.

[6] "Joshua Tree National Monument," California Journal of Mines and Geology, California Division of Mines, 32, no. 3, (July 1936): 382.

[7] Gold also occurs in: 1) high-grade ores suitable for smelting, 2) non-amalgamating ores, 3) placer gold, and 4) complex ores. Laizure, 263; and U.S., Department of Commerce, Bureau of Mines, Gold Mining and Milling in the United States and Canada: Current Practices and Costs, by Charles F. Jackson and John B. Knaebel, Bulletin 363 (Washington, D.C.: Government

metals from the valueless minerals which encase them. Arrastras extracted gold by first crushing the ore with drag stones to release the gold particles. Next, gold was recovered either by panning, sluicing or amalgamation.[8]

DESIGN

The design of the arrastra remained basically the same for more than a hundred years. Miners from Sonora, Mexico, brought arrastra technology northward with them into California in the very early days of the California gold rush. These simple mills were used from 1850 to the 1930s. An arrastra had a short circular retaining wall which ranged in diameter from 8'-20'.[9] It was made of stone or wood, whichever was more convenient. An outlet at the low end was screened or had a gate. Within the wall was a circular floor made of stones which were flat, large and hard. They were set in either rammed clay or concrete which stopped an inch below the surface of the stones. Narrow channels were left between the stones.

There usually was a short stone or wood pillar in the center of the circle, on which a substantial wooden post was set. Between this pillar and the wall was a circular channel. The channel was about 2-1/2' to 6' wide or larger. One or two horizontal beams (making two or four arms) sat on the central pivot post and extended out over the floor. (If two beams were used, they would be at right angles to each other.) A rope or chain was attached to each arm above the channel. The other end of each tether was fastened to an eye bolt which was tightly wedged into a drilled hole in a drag stone. These stones weighed from 150 to 1,000 pounds each and were made of the same hard material as the floor. They were dragged around the circle, on top of the ore. The front edge of a drag stone was slightly beveled, so the ore particles went underneath the drag, instead of being pushed ahead. The drags were positioned so some were near the center

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Printing Office, 1932), 90. Cited hereafter as Jackson.

[8] Selecting a method of treating ore was determined by several characteristics besides the character of the ore, including the amount of capital, the availability of water, and the tonnage expected. Jackson, 91.

[9] Roger E. Kelly and Marsha C.S. Kelly, "Arrastras: Unique Western Historic Milling Sites," Historical Archaeology 17, no. 1 (1983): 86.

and some were near the outer edge, to ensure complete coverage.[10] Dragstones wore out in about six to eight weeks, then were replaced.[11]

PROCESSES

Crushing

Ore, water and, in later years, mercury were the basic ingredients in the milling recipe. The ore and water were added in a certain routine. Sometimes the ore was first partially ground dry, and then water was introduced. Other mills used water from the beginning. The operator controlled the movement of the dragstones; if they started to jump he added water or ore.[12] The stones rode on about 1" to 1-1/2" of ore. The ore was about an inch in diameter when it was put into the arrastra. Sometimes it was broken with a crusher to get it to this size.

When the arrastra was used as a simple grinder, the drag stones ground the ore to a thin pulp or slime, which filtered out the screen in the outlet. The gold was then separated from the pulp using a pan, sluice, or similar method.[13]

A later modification incorporated the use of mercury. The ore was ground to the size of coarse or middling sands, which took about five to seven hours.[14] Mercury was then added to this pulp. The mercury was in a little bottle with a cloth over the top; this was shaken like a salt shaker, all around the arrastra. Approximately one ounce of mercury (about a tablespoon) was used

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[10] Otis E. Young, Jr., Western Mining (Norman: University of Oklahoma Press, 1970), 69-70; and California, State Mining Bureau, California Gold Mill Practices, by Ed. B. Preston, bulletin no. 6 (Sacramento: State Printing, 1895), 58. Cited hereafter as Preston.

[11] Kelly, 87; and Tom Ake, interview by Reino Clark, 6 February 1975, transcript, Joshua Tree National Monument Library, Twentynine Palms, California, 27.

[12] Ake, 27.

[13] Young, 69-70.

[14] Laizure, 269-70, citing W. H. Storms, "How to build an Arrastra," Engineering and Mining Journal (27 May 1911).

for each estimated three-fourths to one ounce of gold.[15] Grinding then continued an additional two or three hours, until the ore was a slime, or fine sand.[16]

The mercury formed an alloy, called amalgam, with the gold. Being heavy, it fell to the bottom. The operator panned samples of the pulp until he found no gold or amalgam, because it had dropped into the recesses.[17] Then he added more water, until the pulp was slushy, and opened the discharge gate. The pulp drained out, leaving the amalgam in the arrastra.[18] These tailings usually drained into sluices lined with copper plates, riffles or blankets, where gold residue was captured. The total time to mill a load of ore (about 2-1/2 tons) varied with the character of the ore, but it ranged from six to twelve hours.[19]

Cleanup

The arrastra was cleaned in two stages: a partial and general cleanup. After the pulp was drained, or perhaps every week or two, the amalgam was cleaned out of the crevices in the floor, using picks, scrapers, spoons, scoops or stiff brushes. Next, the operator panned the amalgam, to clean away the sand, and then retorted it to separate the mercury from the gold. The resulting gold-silver matte or sponge was sent to the U.S. Mint.

The operator thoroughly cleaned the arrastra only after the floor stones wore down, usually every six months.[20] The millman pulled up the floor stones and carefully washed them in a vat. He collected the amalgam from the surface of the clay or concrete beneath with an iron or horn spatula. He panned the amalgam, then retorted it.

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[15] Young, 71; and Kelly, 87.

[16] Laizure, 269-70, citing Storms.

[17] Ake, 27-28.

[18] Ibid.; Kelly, 86; Laizure, 269-70, citing Storms; and Jackson, 108.

[19] "The Arrastra and Its Use," Engineering and Mining Journal 68, no. 26 (23 December 1899): 760; and Laizure citing State Mineralogist's Report, 1896.

[20] Kelly, 87; and "The Arrastra and its Use," 760.

POWER

In the early years of California's gold mining era animals usually provided the power for an arrastra. This is the type of power that we usually associate with these mills. However, humans, steam, and water were also used, and in later years gasoline engines and electricity became common. When animals were the power source, the crossbeams extended over the wall. The mules, horses, donkeys or oxen were harnessed to the beams. As they walked around the outside of the circular wall, the stones were dragged around the channel.

In 1896 over half of the 115 arrastras operating in California were powered by steam engines or water.[21] Water wheels were either horizontal or vertical. On horizontal wheels, the water struck buckets at a 45 degree angle. Overshot wheels were sometimes used with a belt and a pulley which was attached to the center post.[22] One such water-powered arrastra was at the Georgia Mine in Inyo County, California. [23] The water wheel transferred power via a belt to a ten-foot horizontal pulley which was above the arrastra.

Arrastras powered by gasoline engines and electricity were developed in the early twentieth century.[24] They required a reduction in speed via belts and pulleys or gearing. It required about six horsepower to run an average sized arrastra.[25] In the 1930s, any of these power sources could be used.

Arrastras operated at about four to ten revolutions per minute when they were powered by animals, or ten to fourteen r.p.m if powered by water or machines. A speed of fifteen to thirty

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[21] Kelly, 87.

[22] Preston, 60.

[23] A photograph of that site was originally published in the California State Mining Bureau Annual Report for 1896, and was reproduced in Kelly, 89 and in Laizure, 268.

[24] Kelly, 87; "Concentrates," Mining and Scientific Press 101, no. 14 (1 October 1910): 447; and "Usefulness of the Arrastra," Mining and Scientific Press LXXXVI, no. 10 (7 March 1903): 145.

[25] Preston, 60.

revolutions per minute was recommended for working tailings, though this speed was rarely reached when powered by animals.[26]

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

Arrastras were popular for several reasons: the mill was easy and inexpensive to construct - an individual could easily build it himself from native materials; it utilized simple mechanics, so the individual needed only average mechanical ability; an arrastra could be used with a variety of power sources, including animals, water, steam or combustion engines; it could be operated with a minimum of water; it was an effective grinding and amalgamating machine, and good metal extraction was possible; it was well suited for use on free-milling ores, which were common in California; besides low construction costs, the mill was inexpensive to operate - when the mine was played out, the miner could abandon the machine, as he had invested mainly time and labor, with no large financial risk.

Arrastras did have problems, however: they used a primitive technology, the process was slow and laborious, and the quantity of ore milled was small. As a result, it took more energy to run over a longer time. Arrastras were not well adapted to large plants which wanted to process sizable quantities quickly. In an industry where improved recovery and efficiency directly increased profits, the arrastra was inferior to new technologies such as stamp, ball and tube mills, cyanidation and flotation.

Arrastras were best utilized in small-scale settings; the scale could be determined by capital, number of miners or quantity of ore. Little capital investment was required in an arrastra, so it was within the financial reach of an individual or a small company. Even one individual could mine and mill using this machine. Also, an arrastra could service small mines which did not produce enough to warrant the construction of a more sophisticated, modern plant. It could also be used to test ores from new prospects to determine if the cost of additional mining or a larger mill was justified.

Arrastras could also be combined with other milling technology. The circular mills were sometimes constructed below a stamp mill to treat the tailings. The waste water from the stamp mill could be used to power water wheels for the arrastra. These were often

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[26] Kelly, 86; "Concentrates," 447; and Robert H. Richards, Ore Dressing (New York: Engineering and Mining Journal, 1903), 238.

operated by lessors who paid the mine for the tailings.[27] Another combination was used at a plant in Central America. It used an arrastra to grind the ore, which was then treated in cyanide leaching tanks.[28]

A resurgence of gold mining in the 1930s, conducted by amateurs with little capital, brought about an increased interest in arrastras. The U.S. Bureau of Mines and the California Division of Mines still recommended arrastras in the 1930s for preliminary work on prospects in remote regions, when the available capital was small, and for areas of high grade ore which were inaccessible.[29]

OCCURRENCES OF ARRASTRAS

Region

Arrastras had widespread use in the western United States, Canada, and northwestern Mexico. They operated in California from 1850 to the 1930s; there were about 115 arrastras operating in California in 1896, comprising 15-30 percent of all the state's operating mills.[30] They were usually located near water sources; it was noted in 1903 there were over 100 old arrastra beds grouped around springs in the Gavilan district in Riverside County.[31]

Intact specimens are scarce because the operators often dismantled the floor and riffled the ground within and just outside the arrastra to look for amalgam which had seeped into the earth. The remains of several arrastras still exist in parks in the region, including small, crude mills which were probably human-powered, a 1939 mill in Death Valley National Monument, a 1948 mill near Yosemite, and other mechanized specimens.[32]

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[27] Preston, 58.

[28] Teodoro Kohncke, "Inexpensive Home-Made 20-Ton Mill," Mining and Scientific Press XCVII, no. 6 (8 August 1908): 185.

[29] Jackson, 108; and Laizure, 267.

[30] Kelly, 87 citing 1896 Annual Report of the California State Mining Bureau; and Laizure, 270, citing Robert H. Richards, Ore Dressing (New York: McGraw Hill Book Co., 1905).

[31] "Usefulness," 145.

[32] Kelly, 90.

Joshua Tree National Monument

Numerous arrastras were used in the Joshua Tree National Monument area. By October 1873, there were two such mills operating near the Twentynine Palms oasis. There was an arrastra at the Pinyon Well which crushed ore for several small mines in the 1890s. An arrastra was also located at the Henson Well, about 1.3 miles southwest of Pinyon Well.[33] A Reverend Tully used an arrastra for about five years at the turn of the century on the current site of the Wall Street Mill.[34] It was later disassembled, probably by Bill Keys, to reuse the materials. Jonathan W. (Johnny) Wilson built an arrastra at the Oasis of Mara in Twentynine Palms in 1905 to mill ore from area mines.[35] Phil Sullivan and Bill McHaney built an arrastra in 1910 near Twentynine Palms to mill ore from Sullivan's Contact Mine.[36] Bill Keys built two arrastras at his Desert Queen Ranch. One used a gasoline engine and milled quite a bit of ore.[37] The other was built to make use of some wild burros Keys was breaking; however, the animals were uncooperative and the mill was scarcely used.

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[33] Greene, 91, 187, 197.

[34] Perkins Papers, Joshua Tree National Monument Museum, Twentynine Palms, California; and Oran A. Booth, interview by Bill Truesdell and Lysa Wegman-French, 26 June 1991, tape recording, Joshua Tree National Monument Museum, Twentynine Palms, California.

[35] Greene, 54.

[36] William H. (Bill) McHaney, interview by W.E. Ketcham and W. Egbert Schenk, March 1933, transcript, Joshua Tree National Monument Library, p. 2.

[37] Willis Keys, interview by author, 6 August 1991, telephone from Twentynine Palms to North Fork, California, tape recording, Joshua Tree National Monument Museum, Twentynine Palms, California.

THE PINTO WYE ARRASTRA

DESCRIPTION AND SURROUNDINGS

The construction of the Pinto Wye Arrastra is conventional only to a certain extent, since it has a modern component. Traditionally, there would have been crossbeams, pivoting on a central post. The central device on the Pinto Wye Arrastra, however, consists of two concentric wheels. The inner wheel is evidently a wagon wheel. This structural change is apparently due to the power source: a gasoline engine. These wheels were used as pulleys. Only one other wagon wheel arrastra has been noted on National Park Service property at Arrastra Spring, Lake Mead National Recreation Area, Arizona.[38] That mill had a simpler design than the Pinto Wye, and was badly eroded. It was disassembled and a replica was constructed at the visitors' center.

The engine that powered the Pinto Wye Arrastra was a four-horsepower International upright gasoline engine. It drove a belt, which had a quarter turn and went around the outside of the wheel. Local tradition relates that the operators first used only the wagon wheel as a pulley, but found that it went too fast due to the small circumference. The larger wheel was added to reduce the revolutions per minute.[39]

The Pinto Wye Arrastra is about 14′ in diameter. There are 1"-2" gaps between the floor stones, which are set in concrete up to 2" below the surface of the floor. The depth of the recesses and the good condition of the floor indicate that the arrastra was not used extensively. The outer stone wall has an irregular height of about 1′-6" to 2′, with crudely applied concrete mortar.[40] A similar wall surrounds the central round base for

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[38] U.S., Department of the Interior, National Park Service, Alaska/Pacific Northwest/Western Team, Historic Resource Study: A History of Land Use in Joshua Tree National Monument, by Linda Greene (Denver: Denver Service Center, 1983), 107. Hereafter cited as Greene.

[39] Bob Michels, interview by author, 16 July 1991, Twentynine Palms, California.

[40] Bill Keys wasn't impressed with the arrastra because he didn't think it was built with good workmanship. Willis Keys, interview by author, 6 August 1991, telephone from Twentynine Palms to North Fork, California, tape recording, Joshua Tree

the wheels. The drag channel between these two walls is about 2'-6" wide. The 4' center wheel is an iron-tired, wood-spoked, wood hub wheel (apparently a wagon wheel) mounted on a vertical axle. Surrounding that wheel is a 7' wheel built up of lumber. It resembles a bull wheel from a stamp mill; however, the width of the outer edge is smaller, and it is not constructed as sturdily as a bull wheel. Four radial arms extend horizontally from under the wheels over the channel, towards the outside wall. There are dragstones on the site, which would have been connected to the four beams. A rectangular outlet in the southwest (downslope) side of the outer wall is lined with small wood planks on the upper three sides. A concrete basin, about 12' x 4', is located below. There are negligible tailings below the arrastra. The mill is built on a slope, which leads to a dry wash. There is no apparent source of water, so the liquid may have been transported to the site.

Greene described the arrastra as being in excellent condition in 1983. At that time the center wagon wheel showed little deterioration from weather or vandals. Currently the arrastra is in good condition, but the wood wheels are disintegrating due to weathering. There are no visible trails to the site, which has decreased the number of visitors, thereby limiting the amount of vandalism.

There are four small inclined shafts in the Pinto Wye Arrastra area. The closest is about 110' upslope (north-northeast) from the mill; it is about 20' deep. The farthest shaft is about the same depth, and is about half a mile southeast. The other two shafts are also lightly developed. The small amount of ore taken from the shafts matches the little-used condition of the arrastra. It is likely that the arrastra was constructed as a test mill for these prospects. It would have been relatively inexpensive and easy to build. If the mines had proved to be rich, the ore could have been transported to a more sophisticated mill.

A campsite is located about 1100' south of the arrastra. Artifacts include two sets of bed springs and numerous cans. The camp is centrally located among the shafts.[41]

National Monument Museum, Twentynine Palms, California.

[41] The shafts and the campsite were located by Kathy and John Lakey, of Twentynine Palms. Their careful examination of the area was a great aid to this study.

SITE OWNERSHIP AND CLAIMS

No documentary evidence has been found to establish who built the arrastra, who dug the shafts, or when these activities took place. Archaeological evidence places the time period in the 1920s or 1930s.

The arrastra itself and the inclined shaft near it are positioned at the north-south quarter section line, and are apparently barely in the northwest quarter of Section 3, T2S, R9E, S.B.M. Another shaft to the southwest is also in the northwest quarter. This was historically government property. However, the campsite, two other shafts and a small prospect are all in the southern half of Section 3, which was Southern Pacific Railroad land through the 1930s.[42] Dick and Ruth M. Curtis acquired Lots 1 and 2 in Section 3, northeast quarter, southern half. They exchanged these lots for other government lands in 1948.[43]

Mineral claims recorded in the Riverside County records are indexed only by name of claimant (and for some years the name of the mine). Since neither of these pieces of data is known, it was not possible to obtain the records for this site. At any rate, given the apparent short-term nature of the site, it is possible that the miner(s) did not record a claim.[44]

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[42] Southern Pacific Railroad had the 480 acres consisting of the S 1/2 and the NE 1/4 in Section 3, T2S R9E. Riverside County, Assessor's Records, Real Property Ownership Record, County Courthouse, Riverside, California.

[43] Riverside County, County Courthouse, Property Records, 1 February 1949, volume 1048, page 243, Riverside, California; and U.S. Bureau of Land Management, "Exchange Application," by Dick Curtis, Serial no. 068303, 24 April 1947 - 24 May 1949.

[44] When a person filed a claim on a mining site on federal lands, he did not own the property. He only reserved permission to be the exclusive user of the minerals. The miner first posted a notice on the site, declaring that he was locating the claim. He was supposed to record the claim in the county offices within thirty days, though it was not unusual for the recording to be later, or never at all. Miners had to renew their claim annually by filing a proof of labor with the county recorder, indicating they had expended a certain amount of money and labor. Once the claim was abandoned, another person could claim the site.

Odd-numbered sections within a railroad grant that had not been patented could be prospected and located for minerals the same as vacant government land. Claimants on patented railroad

An early prospector, Johnny Wilson, had worked the general area in the 1880s or '90s because he found some gold "float" in a nearby wash. However, a different prospector later discovered the apparent source of the gold: the rich Desert Queen Mine, in the hills about two miles west. Willis Keys recalls that his father, Bill, referred to some later prospectors in the general area of the current site of the arrastra, again attracted by the float. Bill thought they were foolish for working that locale, since the gold came from the Desert Queen. Willis suspects that these prospectors may have built the arrastra.[45]

A claim marker found on the site of the Pinto Wye Arrastra stated that it was the AED lode mining claim, located May 16, 1954, and filed on by Arnold M., Edna (Ed?), and Don M. Benito of Twentynine Palms.[46] This claim was not recorded with the county clerk. The AED claim was made after the arrastra had been built and abandoned. At least part of the reason for claiming the site was to acquire the engine that was still present there. Benito and "Doc" Ince picked up the four-horsepower International engine in an old army truck. They took it to Ince's, where he used it to power his refrigerator. He later traded it to Orville Bright for a painting job. Bright traded it to Bob Michels. A friend of his borrowed it, to put in his yard for decoration. Later he told Michels that someone took the engine from his yard.[47]

CONCLUSION

The Pinto Wye Arrastra is an important example of nineteenth- and twentieth-century milling technology. This specimen is unusual ecause it used a wooden wheel as the pivot mechanism; only two of this type are owned by the National Park Service. It is considered regionally significant because it is the only wagon wheel arrastra yet found possessing integrity of location and construction.

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land needed to obtain the permission, lease, or sale from the owner. C. McK. Laizure, "Elementary Placer Mining in California and Notes on the Milling of Gold Ores," California Journal of Mines and Geology 30, no. 2-3 (April, July 1934): 253.

[45] Willis Keys, 6 August 1991.

[46] Greene, 100.

[47] Bob Michels, 16 July 1991; and Joan Jackson, interview by author, 24 June 1991, Twentynine Palms, California.

Archaeological evidence indicates that the arrastra was built in the 1920s or 1930s. This concurs with the historical gold rush that occurred in the Depression. Individual prospectors worked mines by hand in the western third of the future monument, the setting for the Pinto Wye Arrastra. The establishment of Joshua Tree National Monument in 1936 prevented the location of any new mining claims, so it is likely that the mill was built prior to that date. (It is also possible that there may have been some discreet mining and milling at the site, despite the laws.)

Arrastras were best utilized in small-scale settings; the scale was determined by capital, number of miners or quantity of ore. A small amount of capital investment and only a few people were required to start the process because arrastras were easy to construct and operate; even one individual could use this machine. Arrastras were suited to small quantities of ore because they were slow at processing the rock.

An arrastra had other advantages: it could be easily built with native materials; could be operated with a minimum of water; a variety of power sources could run the mill; it was well suited for use on free-milling ores; and good metal extraction was possible.

Intact specimens are scarce, although the arrastras had widespread use in northwestern Mexico, western Canada and the United States (including the Joshua Tree National Monument area). They operated in California from 1850 to the 1930s.

The Pinto Wye Arrastra is unique because the central device consists of two concentric wheels. A gas engine powered the arrastra, which probably explains this structural difference. Apparently the operators first used only the central wagon wheel as a pulley, but found that it went too fast. The larger wheel was added to reduce the revolutions per minute. There was only one other wagon wheel arrastra on National Park Service property. It was badly eroded, so was disassembled and reconstructed at the visitors' center.

The condition and setting of the Pinto Wye Arrastra provide clues to its history. Judging from the good condition of the floor and the lack of tailings, the arrastra was used very little. The mill is located among four shafts and a campsite. The shafts are all short, and only small amounts of ore were removed from them. This small quantity of ore concurs with the little-used condition of the mill. It is likely that the arrastra was constructed as a test mill for these nearby shafts. Prospectors may have been attracted by gold they found in a nearby wash. Two or more individuals probably built and/or operated the arrastra since there are two sets of bedsprings at the camp.

The Pinto Wye Arrastra appears to be a small-scale, temporary operation, set up by a few speculative miners in the early days of the Depression. They probably used the mill to test the quality of the ore in their prospects. A gasoline engine, the most easily available energy source, powered the mill. The operators used wheels for the central mechanism to accommodate the power source.

APPENDIX A
ARCHAEOLOGICAL ASSESSMENT

In addition to documenting the standing structures and equipment, the 1991 HAER project at Joshua Tree National Monument also evaluated the archaeological resources at the Pinto Wye Arrastra (CA-RIV-4663). Archaeological resources are defined as the physical remains of human activities and may include such things as artifacts, building foundations, privy pits, and food remains. The goals of the archaeological evaluation of the two sites included making an inventory of the archaeological remains, assessing the significance and the integrity of the remains, and making recommendations for the management of the remains. (See sheet No. 2 of 2 of the measured drawings accompanying this report for site plan.)

INVENTORY METHODS

An inventory of archaeological remains at the Pinto Wye Arrastra was taken by walking over the ground surface of the two sites in linear transects at intervals of 10′. In addition other sites in the immediate area that were visible or had been mentioned by informants were visited, although no effort was made to do a systematic pedestrian reconnaissance of the region. The recordation of archaeological remains included preparation of scaled maps and completion of State of California site survey forms; additional architectural drawings and photographs of the standing structures at the two sites were prepared by other members of the HAER team. The archaeological remains located by the survey were classified at five hierarchical levels: artifacts, features, feature-complexes, sites, and site-complexes.

Artifacts

Artifacts are "portable objects whose form has been modified wholly or partially from human activity" (Sharer and Ashmore 1987:65). Most of the artifacts in the inventory either are associated with features or are part of a general "background" scatter that help define the geographical boundaries of sites. Some, however, are isolated objects. Artifacts are important repositories of information about the age of the sites and the activities that have taken place there.

Features

In the most general way, features are non-portable artifacts (Sharer and Ashmore 1987:66). The features have been grouped together into "feature types" on the basis of similarities in physical form, such as shape, size, or artifact content, or function, such as a building foundation or an inclined mine shaft. Feature types defined in the survey area include such things as artifact hot spots (localized concentrations of artifacts such as dumps or scatters), arrastras, footpaths, stamp and concentration mill buildings, ball-mill pad, tailings pond, concrete machine anchor, inclined mine shaft, and building platforms.

Feature-Complexes and Feature-Systems

Feature-complexes are geographical clusters of features. The features in the clusters may be associated with different activities and time periods; however, features in the complex that are associated with the same contemporaneous activity are included in the same feature-system (Hardesty 1988). Most of the features recorded at the Pinto Wye Arrastra site, for example, are associated with the arrastra mill and, therefore, are part of the same feature-system. Other feature-systems in the inventory include such things as hoisting feature-systems associated with mine sites, stamp and concentration mill, ball mills, wells, and domestic households.

Sites

Sites are places or localities with features, artifacts, and other physical remains that are related to human activities that have occurred at that place. Site boundaries include the "context" of artifacts and features such as the soil matrix or physical medium within which they occur (Sharer and Ashmore 1987:77-80).

Site-Complexes

Finally, sites are classified into "site-complexes," which Binford (1983:117) has defined as a geographical cluster of sites associated with activities or events that are "linked together as part of an overall strategy." Several sites in the vicinity of the Pinto Wye Arrastra appear to be linked together as part of a strategy for gold mining and milling.

ASSESSING SIGNIFICANCE

In addition to making an inventory, another goal was to assess the historical significance of the archaeological remains at the Pinto Wye Arrastra. Following the standards and guidelines issued by the Secretary of the Interior (U.S. Department of the Interior 1983; 36 CFR 60.4; National Register Bulletin 16), the remains are significant if they meet the "registration requirements" for listing on the National Register of Historic Places. The registration requirements include eligibility under at least one of four significance criteria; integrity; significance at either the local, state, or national level; at least 50 years old; or of exceptional value if not meeting any of the other requirements (36 CFR 60.4). Draft National Register Bulletin 36 identifies the circumstances under which the archaeological remains of historical sites may be eligible for listing on the National Register of Historic Places.

Significance Criteria

The archaeological remains must be important under at least one of four significance criteria (A-D) to be eligible for listing on the National Register (36 CFR 60; 36 CFR 63; National Register Bulletin 15). Furthermore, the Secretary of Interior's Standards and Guidelines (U.S. Department of the Interior 1983) stipulate that the four criteria are to be applied within historic contexts. Historic contexts should be developed for this purpose. The contexts identify the thematic, geographical, and chronological framework within which the significance evaluation takes place.

Criterion A. Under Criterion A, the site may be significant if the archaeological remains are needed to convey or illustrate or help interpret an historic property strongly associated with an important historical event or theme. What themes should be used are suggested by the thematic framework for American history developed by the National Park Service (U.S. Department of the Interior 1987). In the most general way the themes that are likely to be most appropriate for the Pinto Wye Arrastra include XII.A. Business: Extractive or Mining Industries; XVIII.F. Technology: Extraction and Conversion of Industrial Raw Materials; and XXX.J. American Ways of Life: Occupational and Economic Classes. Historic events and themes associated with "appropriate technology" gold mining in the American West during the Depression Era is the theme. The archaeological remains of historic properties strongly associated with events and themes

may be eligible under Criterion A if they are needed to interpret the property.

Criterion B. Under Criterion B, the archaeological remains are significant if they are needed to convey or interpret an historic property that is strongly associated with the career of an important person. Most archaeological sites are not eligible under this criterion, and there is no evidence to suggest that the Pinto Wye Arrastra is associated with an important person.

Criterion C. Under Criterion C, the archaeological remains are significant if they are needed to convey to the visitor or illustrate or interpret an historic property that is strongly associated with a distinctive engineering or architectural pattern or type or style. The South Dakota State Historic Preservation Center (1985:10-12) identifies several questions that are useful in evaluating mining sites under Criterion C. The questions include (1) Is the technological pattern represented by the site/feature the "first of its kind?" (2) Does the site represent a major change in mining technology? (3) Is the technological pattern represented by the site/feature the "last of an era?" (4) Does the site/feature represent a new or experimental approach to mining technology? (5) Is the site/feature a reasonably well preserved example of a mining technology that is "typical" of a significant time period?

Criterion D. Finally, the archaeological remains are significant under Criterion D if they contain key information needed to answer important scholarly or scientific questions. Three steps are needed to assess the information content of archaeological remains: (1) develop a regional research design that identifies "important" research questions; (2) identify the archaeological "data requirements" of the questions; and (3) determine whether or not the archaeological remains being evaluated contain the critical data. No regional research design has been developed yet for the Joshua Tree National Monument; however, the research questions that are relevant to the Pinto Wye Arrastra are most likely to be associated with mining technology, mining communities, and mining landscapes (v. Hardesty 1988). Some specific questions that might be used, for example, include variability and change in mining technology, the impact of mining technology upon workplace and community, the spatial organization of mining communities, and technological and social adaptation to the "High Desert" of the American West during the Depression Era (v. Hickman 1977).

Levels of Significance. In addition to the four significance criteria, the National Register recognizes three geographical levels or scales at which they may be applied: local, state, and national. Accordingly, archaeological remains are considered to be eligible for listing on the National Register if they are strongly associated with historical events, people, or architectural/engineering patterns that are considered to be important to the local community, the state, or the nation, or if they contain significant information that might be used to answer key scholarly or scientific questions about the local community, state, or nation. For determining National Register eligibility, archaeological remains are equally important at all three levels.

Integrity

In addition to eligibility under at least one of the four significance criteria, the archaeological remains also must have retained enough integrity to convey their significance to the present. The National Register identifies seven elements of integrity: location, design, setting, materials, workmanship, feeling, and association (NRB 16). Draft National Register Bulletin 36 suggests using the concepts of *visibility* and *focus* to assess the extent to which historical archaeological sites have retained integrity. Visibility is the extent to which the physical remains of a historic property have survived and are observable today; focus is the degree to which the physical remains are readable or interpretable and can be linked to the historic property (v. Deetz 1977:94-95). Under Criteria A-C, all of which require that archaeological remains be capable of conveying or illustrating historic properties, both good visibility and focus are needed; however, eligibility under Criterion D requires only good focus.

Age

The National Register also requires that archaeological remains be at least fifty years old to be eligible for listing; however, younger sites may be eligible under the "exceptional" rule if they are especially important. In addition to the age rule, the archaeological remains must be associated with the time period that has been determined to be significant. Since the Depression Era appears to be the period of significance for most mining sites in the Joshua Tree National Monument, older and younger sites may not be significant.

INVENTORY OF THE PINTO WYE ARRASTRA

The Pinto Wye Arrastra is a site-complex that includes an arrastra, a domestic settlement or camp, and three mines (see attached figure pages). Another mine shaft or adit is visible on the hillside about ¼ mile west of the arrastra. The shaft, however, was not visited due to time limitations.

Arrastra

The arrastra includes six features associated with a single feature-complex. Feature 1 is the arrastra. Feature 2 is the concrete catchment basin used for tailings. Feature 3 is the drag stones. Feature 4 is a wooden framework with iron rollers that probably was part of the belts linking the arrastra to the power source. Feature 5 is a lumber scatter. Feature 6 is what appears to be a roadbed or terrace. The artifact assemblage associated with the arrastra site is sparse, widely scattered, and reflects mostly non-domestic activities. Perhaps the most unusual artifacts are two cylindrical sanitary cans with a large rectangular hole cut out of one side. One of the cans is situated inside the arrastra between the iron tired wagon wheel and the "bullwheel"-like wooden framework used to support the drag arms; the other can is isolated downslope from the lumber scatter. The cans appear to be tin can stoves and may be associated with later recreational camping rather than with the arrastra occupation (v. Thomas 1975:84ff).

Mine Shaft 1

A small mine shaft about 100′ north of the arrastra may have been the most immediate source of ore for the arrastra. The mine site includes a feature-complex organized around an inclined mine shaft (Feature 1). In addition to the mine shaft, the mine feature-complex also includes a mine waste rock dump (Feature 2) and a chicken wire framework (Feature 3). Feature 4 is a small leveled terrace or building platform about 50′ east of the incline shaft. The mine shaft complex and the building platform are connected by a footpath (Feature 5). Both the mine feature-complex and the separate building platform may have been part of the same mining operation.

Mine Shaft 2

The second mine shaft located by the survey is on a hillside about ¼ mile southeast of the arrastra. Two features were identified at the shaft. Feature 1 is an incline mine shaft.

Feature 2 is the mine waste rock dump. No artifacts are associated with the shaft.

Mine Shaft 3

A third mine shaft that may be part of the Pinto Wye Arrastra site complex is also on a hillside and about ½ mile southeast of the arrastra. Two features were identified by the survey. Feature 1 is an incline mine shaft. Feature 2 is the mine waste rock dump. Feature 3 is what appears to be a prospect about 100′ west of the incline shaft. No artifacts are associated with the shaft.

Domestic Household Site

The archaeological remains of what appears to be the site of a domestic household about ¼ mile south of the arrastra (see figure 3). The site is situated on a high terrace on the other side of and above the wash running below the arrastra. The camp is approximately 150′ long and 75′ wide. Four features were identified. Features 1 and 2 may be part of a single domestic feature-complex that is probably associated with the arrastra and the four mines. Feature 1 is a geographical cluster of artifacts under and around a rock overhang that appears to have been used as a shelter. The cluster includes bed springs, and the area appears to have been the central focus of domestic activities. Feature 2 is a "background scatter" of domestic artifacts that covers the camp boundaries. Feature 3 is an old roadbed running away from the camp at an azimuth of 130 degrees. Feature 4, however, is a cluster of mostly modern trash next to a large rock complex about 150′ away from the bed springs complex at an azimuth of 125 degrees. None of the artifacts in this feature are associated with the arrastra site-complex.

CHRONOLOGY

The artifact assemblage at the camp was dominated by pocket-size tobacco cans, baking soda cans, key strip-opened rectangular meat cans (spam cans), regular-size evaporated milk cans, and sanitary vegetable/fruit cans. Upright and hinged "Prince Albert" pocket tobacco cans were marketed at least as early as 1907 or 1908 by R.J. Reynolds Tobacco Company and continued until 1988 (Rock 1988:74-75). All of the evaporated milk cans had vent holes, crimped side seams, and flanged end seams, diameters of 2-15/16", and heights of 4". Don Simonis, a Bureau of Land Management archaeologist, has argued that these cans date between 1917 and 1929 (personal communication). Several baking soda cans were identified; the only embossed-lid label read "Calumet/8 oz/Baking

Powder/Full Weight/Absolutely Pure." Calumet Baking Powder Company was founded in the 1890s (Rock 1988:25), and the label appears to be typical of the late 1920s. One colorless glass bottle base with an Owens cutoff scar was observed near the rock overhang. In general the artifact assemblage at the site suggests domestic activities during the 1920s or 1930s.

SIGNIFICANCE

Under National Register Criterion A, the Pinto Wye Arrastra site-complex effectively conveys or illustrates a property type strongly associated with the theme of "appropriate technology" gold mining during or just before the Depression Era. The site-complex also may be significant under Criterion C by illustrating a property type that is strongly associated not only with a distinctive engineering pattern of low cost gold mining and milling in the Depression Era but also with an historic mining landscape. Finally, the site may be significant under Criterion D as a repository of information that might answer several scientific and scholarly questions about mining technology, mining community, and mining landscape. Before the information value of the Pinto Wye Arrastra can be assessed accurately, however, the preparation of a regional research design for mining sites in the American West is required to identify the research questions with highest priority. Even more critical is the development of an historic context for arrastras as a property type, expanding the earlier comparative study of arrastras by Roger Kelly and Marsha Kelly (1983). The historic context then could be used as the beginning of a multiple property document for managing other arrastras in national parks throughout the American West, as discussed below.

INTEGRITY

No equipment or buildings remain at any of the mines; however, the surviving incline shaft and mine waste rock dumps at the mines reflect enough of the property type to be used effectively as an interpretive exhibit. The Pinto Wye Arrastra is better preserved. Not only is the circular grinding pit, stone floor, and catchment basin intact, but also the wooden wheel framework for moving the dragstones across the stone floor of the pit and several of the dragstones. The engine used to run the arrastra, however, is missing and would have to be reconstructed in an interpretive exhibit. The site of the domestic household, finally, is marked only by a refuse scatter outlining the approximate geographical boundaries of the area used for domestic activities.

MANAGEMENT RECOMMENDATIONS

In addition to making an inventory of archaeological remains and evaluating their significance, the purpose of the 1991 Joshua Tree project was to make recommendations for preservation planning. The Secretary of Interior's Standards (1983) stipulates that preservation planning involves the development of "goals and priorities for the identification, evaluation, registration, and treatment of historic properties" (Standard for Preservation Planning II). The key goals for the management of the Pinto Wye Arrastra are (1) the development of an interpretative plan for the two properties, and (2) the development of multiple property documents to more fully place the property within an historic context.

The Development of an Interpretative Plan

Perhaps the most immediate preservation goal should be the development of an interpretative plan that could incorporate the two sites. One approach is to treat the Pinto Wye Arrastra and other historic mining properties in the Monument as parts of a collection to be used in developing exhibits in an outdoor museum of technology and industry (v. Hardesty 1990). The boundaries of such outdoor museums are defined by the mining landscape. Collections in the museum are made up of mine waste rock dumps, mill tailings, standing buildings and structures, archaeological sites, road networks, and the like. Exhibits are organized around the collections by using labels and interpretative graphics, organizing traffic flow, and other museum methods to interpret the history of mining technology and society. Thus, the Pinto Wye Arrastra could play a role as an exhibit in an outdoor museum of technology and industry. In a most general way, for example, the mill is an example of an "appropriate technology" adaptation to the Mojave Desert during the Depression Era. Whether or not the Depression Era adaptation is significantly different from adaptations during the late nineteenth and early twentieth century is a research question with no answer as yet.

The Preparation of Multiple Property Nominations

Another preservation goal is the preparation of more complete historic contexts for the sites. The Pinto Wye Arrastra is an example of an historic property type that might be managed best within the multiple property approach. Within this approach, historic contexts are developed for a single property type such as arrastras that is expected to have a number of examples. Registration requirements for the property type are defined in

the multiple property document; acceptance of the document by the SHPO and the Keeper of the Register implies that the same requirements can be used to evaluate each example of the property whenever they are located. Furthermore, the multiple property document does not place properties on the National Register; rather, it provides a standard historic context and registration requirements for evaluating all examples of the same property type that may be used in developing nominations to the National Register.

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FIGURES

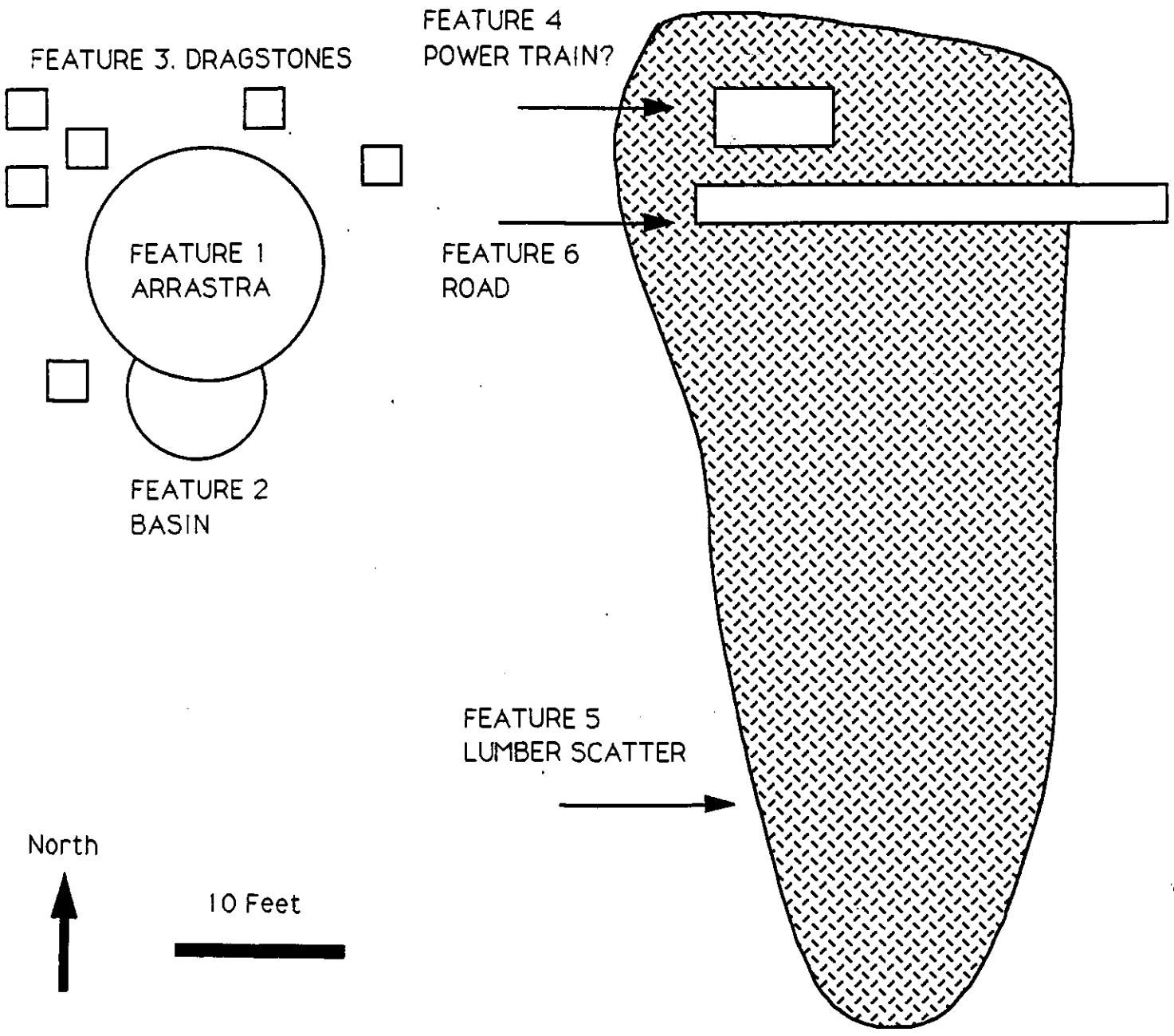


FIGURE 1: ARCHAEOLOGICAL FEATURES AT THE PINTO WYE ARRASTRA

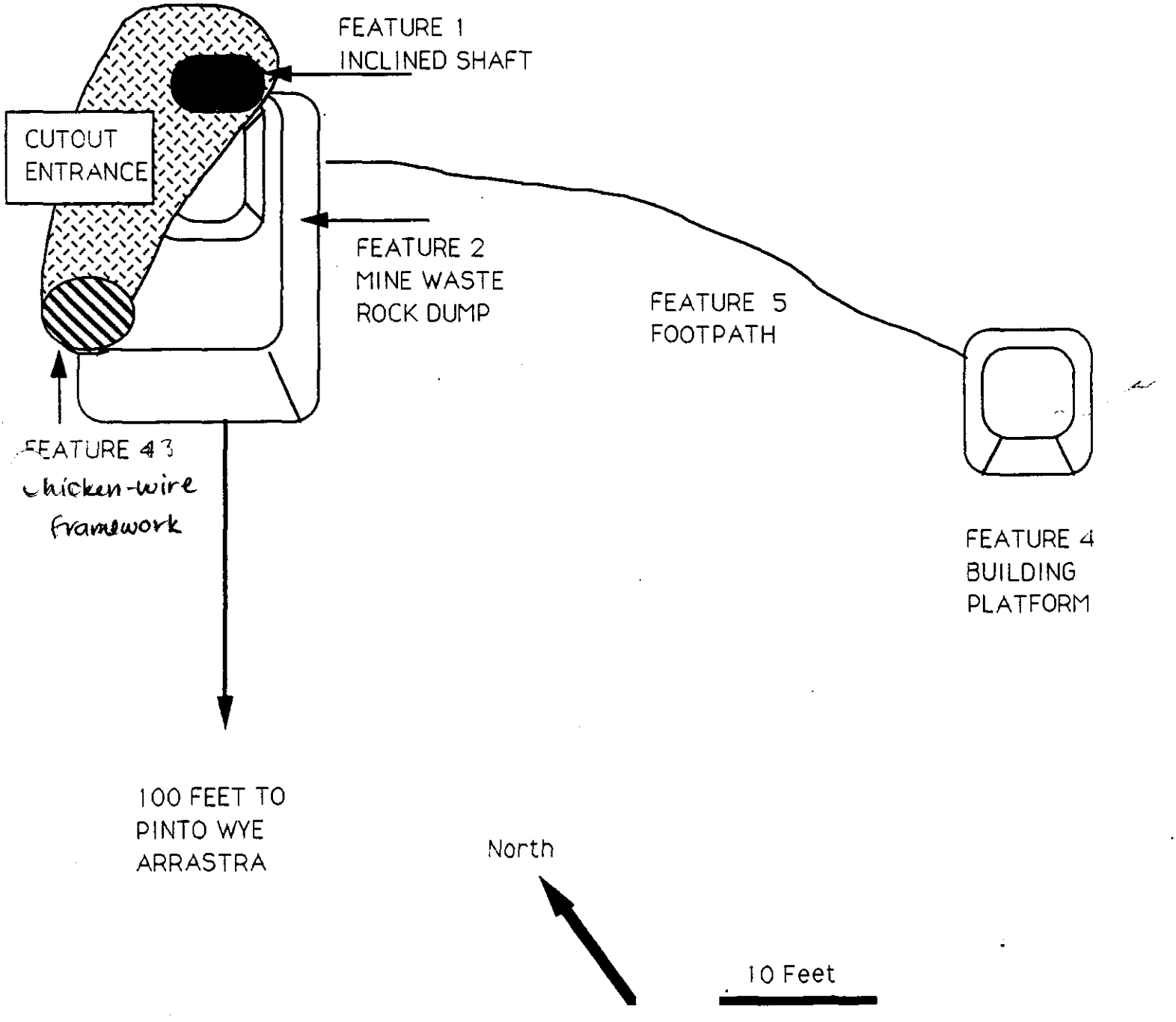
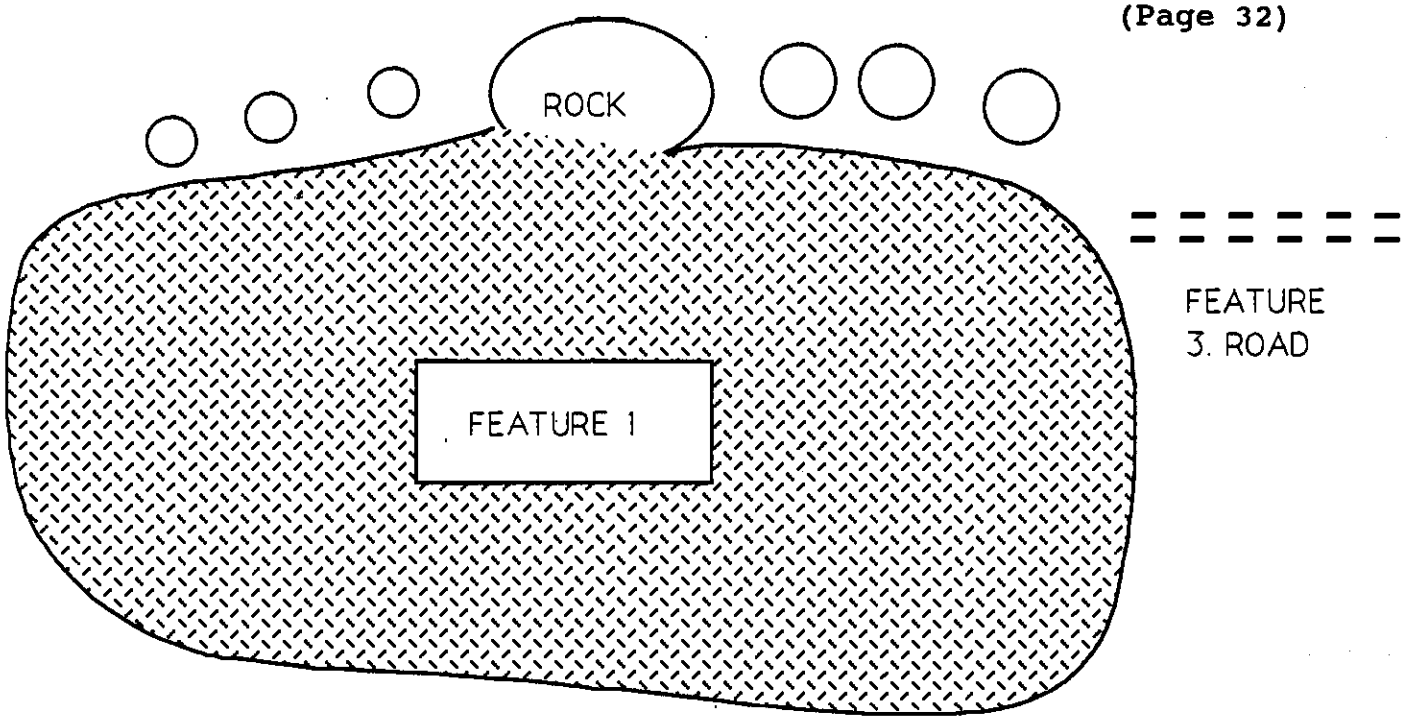


FIGURE 2: PINTO WYE ARRASTRA, MINE NUMBER 1



FEATURE 2. BACKGROUND ARTIFACT SCATTER

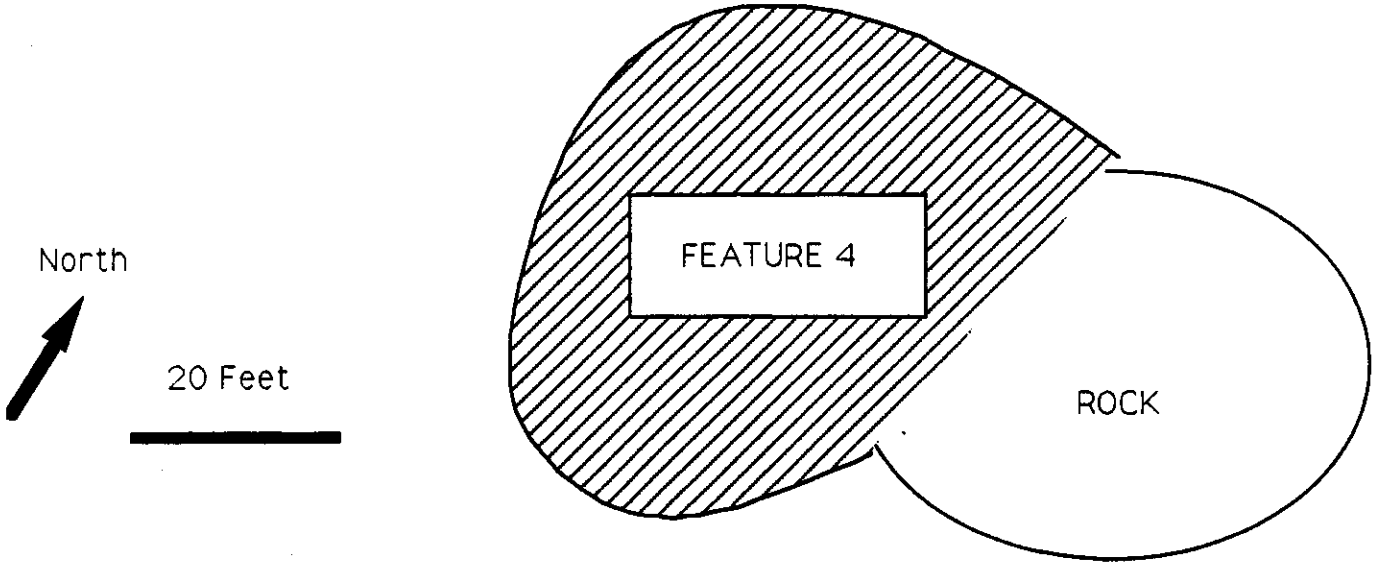


FIGURE 3: ARCHAEOLOGICAL FEATURES AT THE PINTO WYE ARRASTRA DOMESTIC SETTLEMENT

APPENDIX B

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ADDENDUM TO:
PINTO WYE ARRASTRA
Joshua Tree National Park
Twentynine Palms vicinity
San Bernardino County
California

HAER CA-112
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